Safety Data Sheet

Ethylene dibromide

Division of Safety
National Institutes
of Health

WARNING!

THIS COMPOUND IS ABSORBED THROUGH THE SKIN AND THE RESPIRATORY AND INTESTINAL TRACTS. IT IS TOXIC, CARCINOGENIC, AND MUTAGENIC. IT MAY IRRITATE TISSUES. AVOID FORMATION AND BREATHING OF AEROSOLS OR VAPORS.

LABORATORY OPERATIONS SHOULD BE CONDUCTED IN A FUME HOOD, GLOVE BOX, OR VENTILATED CABINET.

AVOID SKIN CONTACT: IF EXPOSED, WASH WITH SOAP AND WATER. AVOID WASHING THE SKIN WITH SOLVENTS AND ELEVATING ITS TEMPERATURE.

FOR EYE EXPOSURE, IRRIGATE IMMEDIATELY WITH LARGE AMOUNTS OF WATER. FOR INGESTION, DRINK PLENTY OF MILK OR WATER. INDUCE VOMITING. FOR INHALATION, REMOVE VICTIM PROMPTLY TO CLEAN AIR. ADMINISTER RESCUE BREATHING IF NECESSARY. REFER TO PHYSICIAN.

IN CASE OF LABORATORY SPILL, WEAR PROTECTIVE CLOTHING DURING CLEANUP. AVOID SKIN CONTACT OR BREATHING OF AEROSOLS OR VAPORS. USE ABSORBENT PAPER TO MOP UP SPILL. AFTER THE RESIDUE HAS EVAPORATED, WASH DOWN AREA WITH SOAP AND WATER. DISPOSE OF WASTE SOLUTIONS AND MATERIALS APPROPRIATELY.

A. Background

Ethylene dibromide (EDB) is a colorless, heavy, nonflammable liquid with an odor similar to that of chloroform. It is readily absorbed through the skin, from the gastrointestinal tract, and by inhalation and is toxic via these routes. Eye and skin exposure may result in irritation. EDB is carcinogenic in rodents, mutagenic to bacteria and insects, and possibly teratogenic to rodents. Its major com-

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mercial use is as a gasoline additive, fumigant, nematocide, intermediate in chemical synthesis, and solvent for gums and waxes.

Chemical and Physical Data

1. Chemical Abstract No.: 106-93-4

2. Synonyms:

EDB	Kopfume	Pestmaster
EDB-85	Unifume	Iscobrome D
Nephis	Fumo-gas	Dibromoethane
Dowfume	Soilfume	Ethylene bromide
E-D-BEE	Soilbrom	Glycol dibromide
Celmide	Bromofume	Sym-Dibromoethane

Ethane, 1,2-dibromo- (9CI)

3. Molecular formula: $C_2H_4Br_2$ structure: $Br\text{-}CH_2\text{-}CH_2\text{-}Br$

weight: 187.88

4. Density: Liquid: 2.1792 g/cm^3; vapor (air = 1): 6.5.

5. Absorption spectroscopy: IR, Raman, NMR, and MS data are listed by Grasselli and Ritchey (1975).

6. Volatility: Vapor pressure, 12 mm Hg at 25°C. (For values at other temperatures, see pp. D-175 and D-189 in Weast, 1981.)

7. Solubility: Slightly soluble in water (0.43 g/100 ml at 30°C); soluble in ethanol, ether, benzene, and most organic solvents.

8. Description, appearance, and odor: Colorless, heavy, nonflammable liquid with chloroform-like odor.

9. Boiling point: 131.6°C.

   Melting point: 9.97°C.

10. Stability: Relatively stable under ordinary conditions. Decomposes slowly in the presence of light. Reacts with aluminum, magnesium, and alkali metals; hydrolyzed by strong alkalis.

11. Chemical reactivity: Oxidized by strong oxidizing agents. Reacts with zinc in ethanol to yield ethylene and zinc bromide.

12. Flash point: No data.

13. Autoignition temperature: No data.

14. Explosive limits in air: No data.

Fire, Explosion, and Reactivity Hazard Data

1. EDB does not require special fire-fighting procedures or equipment. Fire-fighting personnel should wear air-supplied respirators with full-face masks.

2. EDB is nonflammable but may produce hazardous products (vinyl bromide, hydrobromic acid) in contact with flames or hot surfaces.

3. Incompatible with aluminum, magnesium, and alkali metals.

4. No hazardous decomposition products other than those mentioned above are known.

5. Nonspark equipment is not required. When handled in flammable solvents, the precautions required for such solvents will apply.

Operational Procedures

The NIH Guidelines for the Laboratory Use of Chemical Carcinogens describe operational practices to be followed when potentially carcinogenic chemicals are used in NIH laboratories. The Guidelines should be consulted to identify the proper use conditions required and specific controls to be implemented during normal and complex operations or manipulations involving EDB.

EDB penetrates several glove materials readily (Calingaert and Shapiro, 1948; Sansone and Tewari, 1978). This factor should be taken into account when handling EDB.

1. Chemical inactivation: No validated method reported.

2. Decontamination: Turn off equipment that could be affected by EDB or the materials used for cleanup. If more than 100 ml has been spilled or if there is any uncertainty regarding the procedures to be followed for decontamination, call the NIH Fire Department (dial 116) for assistance. Use absorbent paper to mop up spill. After the residue has evaporated, wash surfaces with copious quantities of water. Glassware should be rinsed (in a hood) with acetone, followed by soap and water. Animal cages should be washed with water.

3. Disposal: No waste streams containing EDB shall be disposed

of in sinks or general refuse. Surplus EDB or chemical waste streams contaminated with EDB shall be handled as hazardous chemical waste and disposed of in accordance with the NIH chemical waste disposal system. Nonchemical waste (e.g., animal carcasses and bedding) containing EDB shall be handled and packaged for incineration in accordance with the NIH medical-pathological waste disposal system. Potentially infectious waste (e.g., tissue cultures) containing EDB shall be packaged for incineration, as above. Burnable waste (e.g., absorbent bench top liners) minimally contaminated with EDB shall be handled as potentially infectious waste and packaged for incineration, as above. Absorbent materials (e.g., associated with spill cleanup) grossly contaminated shall be handled in accordance with the chemical waste disposal system. Radioactive waste containing EDB shall be handled in accordance with the NIH radioactive waste disposal system.

4. Storage: Store in sealed ampoules or amber screw-capped bottles with Teflon cap liners, preferably under refrigeration. Avoid unnecessary exposure to light.

Monitoring and Measurement Procedures Including Direct Field Measurements and Sampling for Subsequent Laboratory Analysis

1. Sampling: The recommended method is adsorption on charcoal (NIOSH, 1977a) in glass or stainless steel tubes and desorption with acetonitrile or benzene-methanol mixtures (NIOSH, 1977b). Silica gel and porous polymer packings (Tenax, Chromosorbs, Porapak Q) have also been used as adsorbents. Water sampling may be accomplished by adsorption on charcoal or porous polymers or purging from water samples with nitrogen into an adsorption trap.

2. Separation and analysis: The recommended method, particularly for air monitoring purposes, is GC with a flame ionization detector, using carbon disulfide elution of charcoal adsorbates. Detection limit is 0.002 $\mu g/m^3$ of air (NIOSH, 1977b). Similar procedures have been described (using either flame ionization or electron capture detectors) for the analysis of EDB residues in fumigated commodities. Analytical procedures for the determination of EDB in soil have been reviewed, and these probably can be adapted to biological materials. A method for extraction (Abdel-Kades et al., 1979a) or TLC (Abdel-Kades et al., 1979b) followed by oxidation and molecular emission cavity analysis (MECA) has been described. The detection limit is 0.25 ppm, and recovery is better than 96%. A colorimetric procedure (hydrolytic debromination in the presence of oxidizing agents) has been used for the determination of EDB in air, with a detection limit of 1 ppm in a 10-ml air sample (Rangaswamy et al., 1976).

Biological Effects (Animal and Human)

1. Absorption: EDB is absorbed from the gastrointestinal tract, by

inhalation, and through the skin.

2. Distribution: Few data are available. Mainly concentrated in liver and kidney (Plotnick and Conner, 1976).

3. Metabolism and excretion: This has been studied in detail (Edwards et al., 1970). EDB is an alkylating agent and reacts through one or both bromine atoms with sulfhydryl groups of cysteine, methionine, or glutathione and with hydroxyl groups. The reaction product is oxidized in the animal body to the sulfoxide and acetylated. The metabolites are the urinary excretion products.

4. Toxic effects: Acute LD50s in the rabbit, guinea pig, rat, and mouse are 55, 110, 117, and 420 mg/kg, respectively; the dermal LD50 in the rabbit is 400 mg/kg. Inhalation LC50 in the rat is 300 ppm for a 4-hour exposure. These data place EDB in the category of high toxicity (Rowe et al., 1952). EDB is a strong irritant to animal skin, eyes, and (on inhalation) lungs, leading to pneumonia. Large oral doses produce central nervous system depression with death from respiratory or cardiac failure; autopsy shows liver and kidney necrosis. Similar findings were made in one report of a human fatality after ingestion of EDB (Olmstead, 1960).

5. Carcinogenic effects: Oral administration of EDB to mice and rats produces squamous cell carcinomas of the stomach.

6. Mutagenic and teratogenic effects: EDB is mutagenic to Drosophila and bacteria, but no mutagenicity was found in a mouse assay. Some suspected teratogenicity effects have been noted in rats and mice. Sperm count and morphology in bulls are reportedly affected by EDB.

Emergency Treatment

1. Skin and eye exposure: For skin exposure, remove contaminated clothing and wash with soap and water. Since EDB is readily absorbed through the skin, avoid organic solvents and elevated temperatures. For eye exposure, irrigate immediately with copious quantities of running water for at least 15 minutes.

2. Ingestion: Drink plenty of milk or water. Induce vomiting.

3. Inhalation: Remove victim promptly to clean air. Administer rescue breathing if necessary.

4. Refer to physician. Consider treatment for pulmonary irritation.

References

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